Effect of surface cover on infiltration rate and stability of a cut slope in unsaturated residual soil

ABSTRACT

Rainfall has been considered the cause of the majority of slope failures and landslides that happened in regions experiencing high seasonal rainfalls. Basically, it is well known that infiltration impairs slope stability, but since it is often not measured off directly from the field, its assessment often relies on vague correlation with rainfalls and runoff. Conventionally, infiltration of water is not included in the slope stability analysis. However, most of the slope failure and landslides occurred after prolonged heavy rainfall or antecedent rainfall. The mechanism of the failures was mainly due to the lost of matric suction of soils by rainwater. When the rainwater infiltrates into the slopes, it will start to saturate the soil, thus reducing the matric suction. The rate of water infiltration into the soil and its effect on suction is expected to be influenced by the types of surface cover, soil porosity, weathering grades and angle of the soil slopes. This paper presents results of a field study on the effect of surface cover on the water infiltration rate into a cut slope of unsaturated residual soil. A parametric study is also done to examine the effect of surface cover on the factor of safety of soil slope using the Seep/W and Slope/W programs. The soil infiltration rate as measured from the field test shows an increase from the fully vegetated slope with geosynthetic net, to cut grass slope with geosynthetic net, to geosynthetic net and to bare surface slope only. For a particular surface cover/condition, soil of weathering grade III had higher infiltration rate compared to soils of intermediate grade (IV ï III), grade IV and grade V. The factor of safety obtain from analysis by incorporating matric suction, is much higher than the factor of safety obtained from the conventional slope stability analysis without matric suction. There is a trend of reduction in factor of safety with rain, in particular for slopes with the lesser cover.

Keyword: Cut slope; Landslide; Residual soil; Vegetation